ATTACHMENT - REMARKS

By this Amendment, independent claims 1 and 15 have been amended for clarity and to better define the invention. Other dependent claims have also been amended consistent with the changes to independent claims 1 or 15 and/or for clarity; while dependent claims 26-29 have been canceled. In addition, a new independent claim 30 and dependent claims 31-35 have been added to further claim the present invention and consistent with the restriction requirement read on figures 9a-d. It is submitted that the present application is in condition for allowance for the following reasons.

Initially in the *Claim Objections* section of the DETAILED ACTION, the examiner noted a missing verb in a portion of claim 1. By this Amendment, claim 1 has been amended to add the missing verb "is" as suggested by the examiner.

In the following *Claim Rejections - 35 USC § 103* section, independent claims 1 and 15 together with dependent claims 2-3, 6, 17 and 27 were all rejected under 35 USC § 103 as being obvious over the Koelle published application. However, for the following reasons, it is submitted that these claims are all allowable over this reference.

As now particularly claimed in independent claim 1, the present invention is a sound-absorbing device which is placed in a sound field of open air in order to absorb sound energy from the open air. In furtherance of this purpose, the invention includes a body with one or more cavities, with each cavity having an active outer surface which is in free and movable contact with the open air of the sound field and additionally being free and movable for absorption of acoustic energy from the open air of that sound field. Each cavity also has a volume which is movable in use at least by movement of the active outer surface between inflated/collapsed states or extended/compressed states

by a variation in a gas pressure therein. By changing the volume of the cavity, there is also effected a change in one of an absorption coefficient α or a resonance frequency of the body between a very high value and a very low value substantially lower than the very high value. The invention also includes a means to actively vary the gas pressure in each cavity to actively vary the absorption coefficient α or the resonance frequency of the body and hence the reverberation time of the sound field (or room).

To the inventor's knowledge, this application is the first time that a simple gas filled cavity (or as also claimed in other claims, a series of bodies with such cavities) has been used in the open air of a room to intentionally absorb acoustic energy in the room; much less to intentionally vary the gas pressure in such cavities to actively alter one of the absorption coefficient α or resonance frequency of the body. The uniqueness of this broad idea is also shown by the attached letter dated September 30, 2010 from Dr. Jens Holger Rindel[1], and the reaction noted therein accompanying the presentation of the paper by the inventor outlining the broad idea of the invention at the Acoustical Society of America in 2005 (and after the foreign priority date of the present application).

It will be noted that the term "active" has been used to modify "outer surface" and "open air" to modify the "sound field" to better differentiate the action of the body of the present invention from the prior art Koelle published application. While these terms were not previously used in the application, it is submitted that those of ordinary skill would readily appreciate the "active" nature of the disclosed surfaces in sound

[1] Dr. Rindel is a former professor at the Technical University of Denmark, where the present inventor was one of his pupils; Dr. Rindel received a Ph.D. in acoustics in 1977 from the Technical University of Denmark; and Dr. Rindel is also active or convenor in various ISO/TC committees. For more information see: http://www.odeon.dk/jens-holger-rindel.

absorption and the open air in which the surfaces function (which are also shown in the drawings), and thus to provide basis for the use of these terms. However, if the examiner has any problem with the use of these terms, they can be deleted without detracting from the allowability of the claims.

It will also be noted that the cavity is now described as having the active surface is "in free and movable contact with the open air of said sound field and additionally being free and movable for absorption of acoustic energy from the open air of said sound field". Such is clearly shown in the drawings and evident from the specification.

The cited Koelle published application discloses a "method of muffling the noise of successive components as well as a noise absorber for successive components" (see title). As noted in this reference:

> This [noise muffling] object is achieved by a method of muffling the noise of successive components [1, 2], by which an intermediate layer is placed between the two components, which [components] are spaced away from one another at least in regions, and by which method as a result of the intermediate layer, the sound transmission and/or vibration transmission from one component to the other is reduced, characterized in that an air cushion [5] is inserted as an intermediate layer, and in that the air cushion [5] is placed at least indirectly on at least one surface respectively of each of the components [1, 2]. ... The acoustic effect of the air cushion can be adjusted by way of its internal volume [5C] and/or its internal pressure. [Emphasis added - See ¶ 0008.]

It will be appreciated that the air cushion of the Koelle published application was developed to solve particular problems in the auto industry as noted in the Background section of the patent. As also noted therein, the prior art routinely made use of "conventional sound absorbers ... mainly in the form of fiber nonwovens and/or foam sheets and/or shaped foamed parts" [see ¶ 0003] as noise absorbers for muffling applied as a cover to various parts (dashboard, doors, etc.). However, as further noted,

> Although these are lights [*sic*, light] and reasonable in price, they can be used only to a limited extent because of installation space problems. Although shape foamed parts largely reduce the space problems, their manufacturing requires high expenditures and their mounting is correspondingly expensive and difficult. [Emphasis added - See ¶ 0003.]
>
> In addition, plate absorbers are known as noise absorbers. ... Systems of this type can also only be used to a limited extent, among other things, because of the above-mentioned installation space problems. [Emphasis added - See ¶ 0004.]
>
> On the whole, all these noise absorbers have in common that they increase the total weight of a vehicle and thus also significantly raise its fuel consumption. [See ¶ 0005.]
>
> For the noise reduction, it is also known to feed foam particularly into inaccessible and/or small cavities. However, in addition to increasing the mass, the method also results in problems with respect to the later disposal. [Emphasis added - See ¶ 0006.]

Thus, in summary, the (prior art) covering sound absorbers could not be used in some locations due to space problems (e.g., a lack of space to insert them between the two components), were weighty, and could create disposal problems (e.g., hard to get out, as well as to get in).

From the above, it will also be appreciated that the Koelle published application has taught a specific use of the disclosed air cushion to overcome these noted problems, which is:

> ... a cost-effective and light air cushion, ... which is preferably not filled or only slightly filled, [and which] can be inserted in a simple manner in the respective spaces between the components. ... Furthermore, during the disposal of the components, the air cushion can be removed again in a simple manner [by deflation]. [Emphasis added - See ¶ 0008.]

With the above in mind, those of ordinary skill would appreciate that although a sound absorbing effect is also achieved in the device of the Koelle published application, the mechanism is very different from that of the present invention. In particular, it will be noted that the Koelle published application is directed to sound insulation of a small confined space, while the present invention is directed to reducing

the reverberation time of a large room by absorbing sounds from the open air of that room with one or more (relatively small) bodies in that room. That there are two different mechanisms for absorbing sound disclosed in the Koelle published application and the present invention, and thus how the Koelle published application functions differently from how the present invention functions, those of ordinary skill know and appreciate how energy is dissipated and energy thereby "lost" in an absorber by these two different mechanisms.

In terms of physics, those of ordinary skill would appreciate that the losses achieved with the sound absorber of the present invention are most easily explained by an analogy to a spring-damper-mass system. The air pressure difference between the inside and outside of the absorber creates the spring effect, while the membrane of the absorber itself is the mass. (And one will note that since sound is in fact small air pressure differences, the outside air pressure varies during use.) The damping is also found in the membrane material itself. It is these effects, taking place inside the membrane itself, that produce the loss of acoustic energy obtained with the present invention in the open air.

The air cushion of the Koelle published application has a very different purpose and thus a very different way of obtaining energy losses. In the Koelle air cushion, losses occur because of friction, which occurs by having the cushion (5) pressed into friction contact with each of the components (1, 2); and thus, as stated in ¶ 0008, the "air cushion [must be] placed at least indirectly on at least one surface respectively of each of the components" [emphasis added]. The reason for using air in the cushion (besides the installation space and weight issues as also noted) is thus to make the

cushion press more completely against the components (1, 2), and thus to achieve even greater friction losses than if the cushion had been merely glued. The movements between the layers of the cushion can consequently be much greater, whereby the frictional movements and thereby losses are enhanced in the Koelle published application relative to the prior art sound insulators used in cars as noted in the Koelle published application.

Paragraph 0013 of the Koelle published application (which discusses a "targeted" pressure for the air cushion to optimize sound absorption) is thus teaching that the absorption coefficient of this system [the system comprising both components 1, 2 and the cushion foils 6, 7] can be controlled as a function of frequency of the sound to be absorbed by varying the air pressure. This means that there is some optimum pressure with regards to losses, because if the pressure is too low there will be no effect (since the cushion does not touch the components at all or with sufficient pressure) and if it is too high there will be less friction and losses. And these losses will occur at some frequency which is depending on the different factors of the cushion, components, noise, etc.

In view of all of the above, it will be appreciated that the present invention, particularly as now claimed in amended independent claim 1, is substantially different from the disclosure of the Koelle published application. In particular, it is clearly recited that the cavity of the present invention includes an active outer surface in free and movable contact with the open air of said sound field and additionally being free and movable for absorption of acoustic energy from the open air of said sound field. The taught air cushion of the Koelle published application never has an "active" surface

which is so oriented or which is in contact with the open air for sound absorption. Rather, as noted, both sides of the Koelle cushion are in substantial contact with the components between which the cushion is designed to be trapped and in the closed space thereof. In fact, there is really no equivalent open air sound field in the Koelle published application, as the sound transmission is through the contacting components forming a closed space. In addition, even it the enclosed space, the cushion of the Koelle published application would not function in the same manner as claimed for the present invention.

In addition, it would not be obvious to use the cushion of the Koelle published application in open air either as the examiner seems to suggest. It is rather the specific teaching of the Koelle published application that the cushion is designed to be used between and in contact with two components in a closed space, to muffle the sound transmission between the two components. In an open air sound field, there would be no such components of concern. If the sound field were in a room, it might be obvious to use the cushion of the Koelle published application in the walls (or other closed space) of such a room to absorb the sound and prevent it from leaving the room, but there is no teaching or suggestion that the cushion would provide any useful sound absorption in the room, much less a teaching that it be used "in order to change one of an absorption coefficient α or a resonance frequency of said body between a very high value and a very low value substantially lower than the very high value" as claimed. Rather, without the components to provide the friction sound absorbing action as taught in the Koelle published application, there is no teaching, other than the hindsight

reconstruction from the present invention, that such a cushion would have any useful effect in an open air sound field.

Further, it would not be obvious from the Koelle published application to actively vary the gas pressure of the cushion thereof even if it were for some reason (and against the teachings of the Koelle published application) placed in the open air of a sound field as claimed. The Koelle published application teaches that the inflation pressure of the cushion in use in the closed space is varied to effect the contact pressure of the walls thereof against the components. In open air, there would be no components against which to change the contact pressure, and thus no need to have a means to vary this pressure in use.

Therefore, for all of the foregoing reasons, it is submitted that amended independent claim 1 is not made obvious by the disclosure of the Koelle published application so that claim 1 is thus now allowable. And for at least these same reasons, it is also submitted that claims 2-3, 6 and 27 (and claims 4-5 and withdrawn claims 8-9) dependent from claim 1 are also allowable.

In amended independent method claim 15, similar features to those discussed above are also now present. In addition, it will be appreciated that claim 15 has been amended to claim a series of resilient bodies for the sound field and the mounting of these bodies in the sound field to absorb acoustic energy from the open air in the sound field. Such a series of resilient bodies mounted as claimed is also not taught or made obvious by the Koelle published application, which only teaches a single cushion for mounting in a defined and mostly closed space. Thus, it is submitted that amended independent claim 15 is also allowable for the same reasons as discussed above for

amended independent claim 1 as well as for this additional reason. And for at least these same reasons, it is also submitted that claims 16-17 dependent from claim 15 are also allowable.

New independent claim 30 is directed to a sound absorbing system which makes use of a series of sound absorbing devices having a structure as set forth in independent claim 1, and similar to the recitation in amended independent method claim 15 as noted above, a mounting means for mounting the devices for absorbing acoustic energy from the open air in the sound field. In addition, independent claim 30 recites that the sound absorbing devices have first and second sides, "with at least one of said first and second sides having free and movable contact to the open air in the room". Further, claim 30 recites that each body of the sound absorbing devices includes one or more cavities, which cavities include "first and second opposed surfaces with one of said opposed surfaces forming in use the one of the first and second sides having the free and movable contact with the open air of the room and additionally being free and movable for absorption of acoustic energy from the open air of the room". Such additional features are also not taught by the Koelle published application.

Therefore, it is submitted that new independent claim 30 is also allowable for the same reasons as discussed above for amended independent claim 1, and additionally for independent claim 15; as well as for the additional reasons as noted above. And for at least these same reasons, it is also submitted that claims 31-35 dependent from claim 30 are also allowable.

It will also be noted that new dependent claim 35 recites that the pressure means varies the gas pressure in at least two of the cavities separate from each other. There

is no teaching or suggestion of varying pressures in two different cavities in the Koelle published application, so it is submitted that new dependent claim 35 is additionally allowable over the Koelle published application for this reason.

Also in the *Claim Rejections - 35 USC § 103* section: dependent claims 4 and 16 were rejected as being obvious over the Koelle published application in view of the Guilloud patent; dependent claim 5 was rejected as being obvious over the Koelle published application in view of the Davis published application; and dependent claim 7 was rejected as being obvious over the Koelle published application in view of the AAPA. However, it is submitted that these claims are allowable at least for the same reasons as discussed above for the independent claims from which they depend.

Finally in the Action, the following claims were indicated as being allowable:

a) independent claim 10 and its dependent claims 11-14;

b) independent claim 18 and its dependent claims 19-20; and

c) independent claim 21 and its dependent claims 22-25.

This indication of allowable subject matter is appreciated; and these claims thus remain allowable.

For all of the foregoing reasons, it is submitted that the present application is in condition for allowance and such action is solicited.

Respectfully submitted,

Date: October 20, 2010

/Douglas E. Jackson/

Signed By
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To: The relevant examiner at the US patent Office

From:

Jens Holger Rindel,
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Re: U.S. Patent Application No. 10/587,898

This present invention, U.S. Patent Application No. 10/587,898, is based on the discovery of surprisingly high airborne sound absorption properties found under certain conditions in flexible inflated structures simply installed in air in a room.

The discovery of this was also the basis of the scientific paper "Variable low frequency absorber for Multi Purpose Concert Halls" submitted to and awarded at the annual conference of the Acoustical Society of America in Vancouver 2005, authored by the applicant of the above mentioned patent application. To my knowledge sound absorption properties of such structures has never previously been thought of, investigated, nor found. The acoustician's community is a quite small group of people that meet regularly at conferences around the world.

This discovery makes it possible to construct absorbers for airborne sound absorption with some desirable features; one is that they can be designed to work at low frequencies; another is mobility since they can be constructed with a low weight (and volume when collapsed); and a third feature is the possibility of switching them on and off. One on/off system is already in use in an arts performance center in Denmark and there are other attempts as to use the mobile technology at other indoor amplified-music events where they are an obvious choice for improving the acoustics.

Sincerely

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